

REMARKS

Claims 1-7, 10, 17, 17-23, and 26 are rejected under 35 USC §102(e) as being anticipated by Ghosh, US 6,011,813.

Independent claim 1 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel. The iterative equalizer includes a first filter for filtering received data according to first filter parameters. A combiner modifies the first filtered data with second filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on the received data.

Independent claim 17 is a method claim associated with the apparatus of claim 1.

The Examiner contends that Ghosh '813 describes what is essentially a decision-feedback equalizer or adaptive filter combined with a technique to easily update the parameters of the first and second filters.

The decision-feedback equalizer of Ghosh '813 recovers data transmitted over a data channel using a first filter, a combiner, a decision device, and a second filter. However, the decision-feedback equalizer has significant differences from the invention recited in claims 1 and 17.

The decision-feedback equalizer is not iterative in the same sense as the claimed iterative equalizer. The term "iterative" can be applied to the adaptive filter because the decision device makes decision on the transmitted data one at a time in sequential order. In this sense, making a decision on one data symbol is considered one iteration. However, the decisions made at the decision device of the decision-feedback equalizer shall not be called "tentative" decisions because the decisions are always final and unchangeable.

In contrast, the claimed iterative equalizer is iterative in two ways. First, the decision device of the block-iterative equalizer has the option of making decisions on the transmitted data one at a time in sequential order, making it iterative in the same sense as the adaptive filter. These decisions are called "tentative decisions" because they are only temporary and can be changed. Second, by the process of refiltering the received data with the first filter, filtering the most recent tentative decisions with the second filter, combining the outputs of the filters, and using the decision device, the entire block of tentative decisions is repeatedly replaced. Each replacement of the entire block of tentative decisions is considered an iteration, and each iteration is designed to improve the quality of the tentative decisions. The tentative decisions of the final iteration performed are called the final decisions. It is this second type of iteration for which the claimed iterative equalizer is named. Note that the claimed iterative equalizer uses the first type of iteration as well as the second type of iteration.

The second filter of the decision-feedback equalizer of Ghosh '813 filters final decisions made for symbols occurring before the symbol of interest, while the second filter of the claimed iterative equalizer filters tentative decisions made for symbols occurring both before

and after the symbol of interest. In other words, the second filter of the decision-feedback equalizer of Ghosh '813 is strictly causal, while the second filter of the claimed iterative is non-causal.

Moreover, the second filter of the decision-feedback equalizer of Ghosh '813 filters final decision made during the current (and only) iteration of the second type, while the second filter of the claimed iterative equalizer filters tentative decisions made during the previous iteration of the second type. Thus, Ghosh '813 does not anticipate either of claims 1 and 17.

As to claims 2-7, 10, 17-23, and 26, they are dependent on claims 1 and 17, respectively. Therefore, claims 2-7, 10, 17-23, and 26 are also allowable for the same reasons argued with respect to claims 1 and 17.

Claims 11, 12, 15, 16, 27, 28, 31, and 32 are rejected under 35 §USC 103 as being unpatentable over Ghosh '813.

Independent claim 11 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel having channel parameters. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel

parameters. The received data is encoded for error-correction coding, and the decision device comprises an error-correction decoder and further comprising an encoder for error-correction encoding the tentative decisions from a previous iteration.

Independent claim 15 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel parameters. The equalizer is fractionally spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data.

Independent claim 27 is a method claim associated with the apparatus of claim 11.

Independent claim 31 is method claim associated with the apparatus of claim 15.

Claims 11 and 27 have similar limitations recited in claims 1 and 17, respectively. However, claims 11 and 27 further recite that the first and second filter parameters are based on an estimate of the channel parameters. In addition, the received data is encoded for error-correction coding, and the decision device comprises an error-correction decoder and further

comprises an encoder for error-correction encoding the tentative decisions from a previous iteration.

The arguments provided herein regarding claims 1 and 17 are also applicable to claims 11 and 27. In addition, Applicants disagree that it would be obvious to use error-detection coding and error-detection decoding given Ghosh 813's deficiencies with respect to the use of tentative decisions and the claimed second filter of the iterative equalizer. Therefore, Ghosh '813 does not render obvious claims 11 and 28 because the deficiencies of Ghosh '813 argued in claims 1 and 17 are not obvious to one of ordinary skill.

As to claims 12 and 28, they are dependent on claims 11 and 27, respectively. Therefore, claims 12 and 28 are also allowable for the same reasons argued with respect to claims 11 and 27.

Claims 15 and 31 have similar limitations as claims 1 and 17, respectively. However, claims 15 and 31 further recites that the first and second filter parameters are based on an estimate of the channel parameters. In addition, the equalizer is fractionally spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data.

The arguments provided herein regarding claims 1 and 17 are also applicable to claims 15 and 31. Moreover, Applicants disagree that it would be obvious to sample the received data at a higher rate than a symbol rate associated with the received rate given Ghosh '813 deficiencies with respect to the use of tentative decisions and the claimed second filter of the iterative equalizer. Therefore, Ghosh '813 does not render obvious claims 15 and 31 because

the deficiencies of Ghosh '813 argued in claims 1 and 17 are not obvious to one of ordinary skill.

As to claims 16 and 32, they are dependent on claims 15 and 31, respectively. Therefore, claims 16 and 31 are also allowable for the same reasons argued with respect to claims 15 and 31.

Claims 8, 13, 14, 24, 29, and 30 are rejected under 35 §USC 103 as being unpatentable over Ghosh '813 in view of Meehan, US 6,115,419.

Independent claim 13 recites an iterative equalizer for a data communication system for recovering received data transmitted over a plurality of data channels having. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel parameters. The received data comprises a plurality of received signals received over the plurality of data channels, and the equalizer further comprises a like plurality of the first filters corresponding to the plurality of channels.

Independent claim 29 is method claim associated with the apparatus of claim 13.

Meehan '419 describes a device for improving signal reception in a signal receiver. The device comprises a beamforming circuit and decision feedback equalizer circuit. The beamforming circuit includes two branches with each circuit branch having two feedforward equalizer circuit and an adder circuit.

Claims 13 and 29 have similar limitations as claims 1 and 17, respectively. However, claim 13 and 29 further recites that the first and second filter parameters are based on an estimate of the channel parameters. In addition, the received data comprises a plurality of received signals received over the plurality of data channels, and the equalizer further comprises a like plurality of the first filter corresponding to the plurality of channels.

The arguments provided herein regarding claims 1 and 17 are also applicable to claims 13 and 29 with respect to Ghosh '813. Moreover, Applicants disagree that it would be obvious to have a plurality of data channels given Ghosh '813 deficiencies with respect to the use of tentative decisions and the claimed second filter of the iterative equalizer. Furthermore, Meehan '419 does not address the deficiencies of Ghosh '813. Therefore, the combination of Ghosh '813 and Meehan '419 does not render obvious claims 13 and 29 because the deficiencies of Ghosh '813 argued in claims 1 and 17 are not obvious to one of ordinary skill.

As to claims 14 and 30, they are dependent on claims 13 and 29, respectively. Therefore, claims 14 and 30 are also allowable for the same reasons argued with respect to claims 13 and 29.

Claims 8 and 24 are dependent on claims 1 and 17, and incorporate the limitations of claims 1 and 17, respectively. Meehan '419 does not address the deficiencies argued with

respect to Ghosh '813 in claims 1 and 17. Thus, the combination of Ghosh '813 and Meehan '419 does not render claims 8 and 24 obvious.

Claims 9 and 25 are rejected under 35 §USC 103 as being unpatentable over Ghosh '813 in view of Agazzi, US 6,236,645.

Agazzi '645 describes a communication line having a plurality of twisted wire pairs connects a plurality of transmitters, one transmitter at each end of each twisted wire pair, with a plurality of receivers, one receiver at each end of each twisted wire pair.

Claims 9 and 25 are dependent on claims 1 and 17, and incorporate the limitations of claims 1 and 17, respectively. Agazzi '645 does not address the deficiencies argued with respect to Ghosh '813 in claims 1 and 17. Thus, the combination of Ghosh '813 and Agazzi '645 does not render claims 9 and 25 obvious.

In view of the foregoing, Applicants respectfully submit that Ghosh '813, taken alone or in the suggested combinations, does not anticipate the invention under the provisions of 35 USC §102, nor does it support a *prima facie* case of obviousness under the provisions of 35 USC §103. Accordingly, Applicants contend that the pending claims are patentable over the prior art of record, and an early indication of same is requested.

Respectfully submitted,

Matthew E. Connors
Matthew E. Connors

Matthew E. Connors
Registration No. 33,298
Samuels, Gauthier & Stevens
225 Franklin Street, Suite 3300
Boston, Massachusetts 02110
Telephone: (617) 426-9180
Extension: 112